Risk Reduction with Technology: Initial Tools for The Hickory Fire Department

Leading Community Risk Reduction

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Abstract

The Hickory Fire Department (HFD) received a grant to purchase mobile computers for apparatus to facilitate the use of a hazardous materials management system called E-Plan. The Hickory Fire Department had not identified the operational components to complement the grant funding.

The purpose of this research was to identify the operational components. Descriptive research was used to answer the following: (1) what type of mobile data computer and component specifications would provide the performance requirements needed to access and facilitate the use of the E-Plan system, (2) what options are available for connectivity, (3) how data would be entered and retrieved and who would oversee this process, (4) how other fire departments have facilitated E-Plan system access, entry and retrieval of data, and what method was used to select mobile data computers for this application.

To answer the first question, a review of E-Plan computer requirements and computer models was conducted. To answer the second question, four connection providers were selected for evaluation. To answer question three, a review of the E-Plan system was conducted to determine the mode of entry and retrieval of information, and who would oversee this process. A survey instrument was designed and utilized to answer the fourth question.

The results revealed that E-Plan is as easy as accessing the Internet and obtaining clearance. Two laptop computers were found to be suitable for emergency service use and one connection provider was found suitable for further consideration. The majority of departments returning feedback forms provided limited information for this project. Ultimately, if those with decision-making authority do not find either of the two computers and the connection provider suitable then others should be researched.

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Introduction

In this modern age, hazardous materials impact our way of life everyday. They are an integrate part of our society. Hazardous materials are widely used for different processes and manufacturing. These range from water purification to controlling weeds. Many of the properties that make hazardous materials so useful can also pose hazards to the public, property, and the environment if they are used in an unsafe manner, disposed of improperly, or released into the environment (United States Environmental Protection Agency [EPA], 1999). As the use of hazardous materials continues to rise, so does the risk for potential accidents.

A local government's core obligations are health and safety, public welfare and security, emergency response, and the safeguarding of public assets (Young, 2000). Most emergency responses to incidents are routine-type situations that do not require special resources to stabilize. Local jurisdictions, however, should be prepared for the risk that natural or man-made disasters and hazardous materials incidents will cause or reinforce each other (National Response Team [NRT], 2001). The repercussions of a violent tornado could result in a collapse of a chemical manufacturing plant that in turn causes an uncontrolled discharge of hazardous materials stored inside a building.

In most businesses, time is money. In the business of responding to hazardous materials emergencies, however, time also translates to saving lives and property. When these types of emergencies occur first responders are usually the first lines of defense within a community. Emergency personnel, however, frequently do not have timely information to respond safely to hazardous materials incidents. Not having the information on stored or potential hazardous materials decisions about the measures that need to be taken to mitigate incidents can prove to be disastrous. Sun Tzu, an ancient Chinese general, wrote a comprehensive guide to warfare in 600

BC that was called "The Art of War." A chapter of this book warned all readers that knowledge of the enemy is paramount (Peterson, 2004). It doesn't take much imagination to realize that these words of wisdom still apply today, not just for warfare but also for emergency response. Even building construction experts like Frank Brannigan warn of the necessity of knowledge of the enemy when responding to structure fires.

Conducting pre-incident surveys are essential in hazardous materials response. In many cases however, maintaining accurate and up-to-date information on these facilities becomes a major challenge. The other concern with hazardous materials is unknown substance responses. The material must be identified in order to start implementing strategies to stabilize the incident. This requires additional time once the material has been identified. In addition, responders must become proficient in using the resource materials provided on apparatus for hazardous materials response. It is imperative that first responders have quick access to up-to-date and accurate information in order to make the critical decisions necessary for their personal safety as well as the safety of the community and the environment.

The problem is the (HFD) has received a grant to purchase mobile data computers for apparatus to facilitate the use of a secured web-based hazardous materials information system called E-Plan, but has not identified the operational components to complement the grant funding. The purpose of this applied research project is to identify the operational components that would complement the grant funding in this process.

Descriptive research methods were used to answer the following questions.

1. What type of mobile data computer and component specifications would provide the performance requirements needed to access and facilitate the use of the E-Plan system?

2. What options are available to provide the connectivity for accessing the E-Plan system?

3. How would data be entered and retrieved and who would oversee this process?

4. How have other fire departments facilitated E-Plan system access, entry and retrieval of data, and what method was used to select mobile data computers for this application?

Background and Significance

The City of Hickory is nestled between the Great Smoky Mountains and the piedmont of western North Carolina. Hickory is home to a wide array of textile plants, storage facilities, distribution centers and numerous large manufacturing corporations. The service area of the HFD encompasses approximately 42 square miles and serves a population of approximately 42,000. While the service area is mainly urban, there are major transportation highways and a major railroad that are incorporated throughout the city limits. The HFD provides services out of seven fire stations with 125 paid personnel. Fire suppression personnel work 24-hour shifts and operate on a three-platoon system, rotating 24-hours on duty and 48-hours off duty. During the 2003-2004 fiscal year HFD personnel responded to 4,400 emergency calls. The HFD also provides Emergency Medical Services (EMS) within the coverage area. The mission of the HFD is to prevent fires, save lives and property, and protect the environment (HFD, 2004).

The possibility of encountering hazardous materials at a given incident is more prevalent today than in years past. This has also led to a new dimension of risk to first responders and to the community where they are located or transported. According to the U.S. Department of Labor, "there are an estimated 650,000 existing hazardous chemical products, and hundreds of new ones are being introduced annually" (U.S. Department of Labor: Occupational Safety & Health Administration [OSHA], 2003). While most major disasters involving hazardous materials are rare, reported incidents involving spills, leaks, and releases

are becoming more common (NRT, 2001). In the United States, it is estimated that 4.5 million facilities use, manufacture, or store hazardous materials. These facilities range from hardware stores to major industrial complexes (Bullock & Haddow, 2003). The HFD is not immune from these types of facilities, or other means by which hazardous materials are transported.

Fire departments respond to a multitude of emergencies other than fires. These include medical and rescue calls as well as hazardous materials. Traditionally, firefighters are trained from the beginning of recruit school to be aggressive in their fire attack methods. However, a different mindset must be learned and applied when responding and dealing with hazardous materials incidents. These incidents have proven to be not only dangerous but also disastrous (Peterson, 2004). The potential risks associated with these type incidents are substantial. The type of material involved, quantity, location, and weather conditions are just some of the types of information firefighters need early in an incident to reduce the risk to themselves, the community, and the environment.

Throughout the United States, most local government entities have come to realize the importance of planning for disasters. In turn, most have developed multi-hazard plans that incorporate procedures and guidelines for response to large-scale emergencies or disasters (Bullock & Haddow, 2003). The City of Hickory's Emergency Operations Manual was developed to deal with disasters, large-scale emergencies, and other hazards which could endanger lives, property, or the environment within the city. The plan identifies the roles and responsibilities of each responding agency. Defining the roles and responsibilities reduces the confusion, chaos, and conflict during disasters and decreases the vulnerability of the public, their property, and the environment to hazardous threats (City of Hickory, 2002).

Some of the roles and responsibilities assigned to the fire department through the Emergency Operations Manual that relate to hazardous materials are as follows:

- Assume command and control of emergencies involving hazardous materials and coordinate the efforts of all agencies involved.

- Record the types and amounts of hazardous materials located within the City of Hickory.

- Provide hazardous materials decontamination.

- Alert all emergency support services to the dangers associated with technological hazards.

- Advise decision makers on the hazards associated with hazardous materials.

To meet these obligations, training was carried out to meet the command and control issues and decontamination objectives. Laws such as the Emergency Planning and Community Right-to-Know Act of 1986 and North Carolina Right-to-know Act have been passed to assist fire departments with collecting information about hazardous materials. The method used to accomplish this are Tier I or Tier II forms. A Tier I form is a standard form that a facility is required to submit. A Tier II form maybe requested in order to provide more detailed information. Recording the types and amounts of hazardous materials remains an ongoing process due to constant changes in storage, usage, and transportation throughout the city. In order for firefighters to advise those in authority on hazardous materials they must have quick access to this information. There are also other factors that must be reviewed and taken into consideration before recommendations can be passed to our decision makers that need to be part of the package assessment. Some of these include current weather conditions, reactivity, and physical properties of the material, flammability, public health considerations, facility or area

drawings with critical infrastructure components as well as federal, state, and specialized resources. Currently, most of these types of information are paper documents that require time to gather and retrieve. During the last decade strides have been made in computer technology that have proven to be a valued asset to the fire service. Fire departments now employ the use of computer technology to manage and track personnel, equipment and apparatus inventories as well as a variety of data management programs. Fire departments are now starting to incorporate this technology in apparatus to provide firefighters with the tools needed to extract quick and accurate information on hazardous materials. Those of us who are in the fire service are all too familiar with managing hazardous materials incidents and not being able to quantify your decisions because of a lack or access of information about a particular material.

Having mobile data computers in apparatus with the accessibility to E-Plan would allow firefighters to quickly access and retrieve critical information on hazardous materials and reduce potential risks to life, property, and the environment. Additionally, this allows the fire department to manage its response more effectively. An effective response helps the HFD to accomplish its mission to save lives and property, prevent fires, and protect the environment.

E-Plan was developed in conjunction with the University of Texas and the United States Environmental Protection Agency. It is a web-based integrated contingency handling and planning system. It is intended to simplify the procedure of filing and maintaining regulatory requirement documents by the facilities and to provide rapid access to emergency responders on hazardous materials in the event of an emergency (E-Plan Newsletter, 2004). Through the use of a valid user identification and password emergency personnel have confidential access to potential life-saving information at facilities. In case of other spills or other accidents, responders can find important information using the Internet. Due to the fact that facilities will

be reporting confidential and critical information security was incorporated with the utmost importance. E-Plan also has other critical links for emergency responders access during an incident. These include the National Institute of Occupational Safety and Health (NIOSH) Pocket Guide, U.S. National Response Team, chemical search, Chemical Hazards Response Information System (CHRIS), United States Environmental Protection Agency (USEPA), North American Emergency Response Guidebook, and weather information as well as many other vital links for hazardous materials response. The E-Plan system was developed using common available Internet tools and protocols to allow easy distribution and communication of information.

This applied research project is relevant to the Leading Community Risk Reduction (LCRR) course at the National Fire Academy (NFA). In particular, it is directly related to the terminal objective of unit 2: assessing risk. "The student will be able to apply a process to assess risks within their own community" (NFA Student Manual, SM2, 2002). An enabling objective of unit 8: Intervention Strategies states, "The student will consider acceptable solutions for identified risks" (SM-8-2).

The United States Fire Administration has five operational objectives. Two are related to this applied research project. One is "to promote within communities a comprehensive, multi-hazard risk reduction plan led by the fire service organization and to respond appropriately in a timely manner to emerging issues" (United States Fire Administration, EFO handbook, 2002, P.II-2).

Literature Review

Perhaps the most daunting task at hazardous materials incidents for emergency responders has been to accurately and properly assess the risks posed to themselves, the public, and the environment. Another concern has been due to a lack of incidents within some departments

there has also been a general lack of knowledge of hazardous materials and their chemical and physical qualities. This has resulted in emergency responders feeling like they are out of their element and comfort zone when dealing with these types of incidents. Coupled with the anxiety of the moment, responders also may suffer from analysis paralysis, in which an exorbitant amount of time is spent trying to figure out the nature of the hazardous material that's been released or in simply over thinking the situation. Issues like these can result in inefficient responses and potentially dangerous consequences for emergency responders.

During the last decade, computer technology, software components and Internet based systems are providing emergency responders with cutting edge technology to facilitate critical hazardous materials information from laptop computers in their apparatus. In order to facilitate the use of such technology, operational components and specifications must be identified to support the E-Plan system.

The E-Plan system is a secure web-based integrated contingency handling and planning system. It is intended to simplify the procedure of filing and maintaining regulatory documents by the facilities and provide rapid access to facility information to emergency responders in the event of an emergency. E-Plan was developed using common available Internet tools and protocols. "One of the key operational components of the E-Plan system is the use of the Lightweight Directory Access Protocol (LDAP) as the repository for facility information. LDAP is an open-standard protocol for accessing information services" (E-Plan, 2004, p.1). In simple terms, this allows information to be distributed among many systems. Using Internet Standards to build E-Plan has allowed for easy communication and distribution of information. Therefore, accessing E-Plan has proven to be as easy as obtaining Internet service and going to the website on a standard desktop or laptop computer.

Operational components such as type of computer and components specifications must be examined to determine operational efficiency when employing the E-Plan system. The most important element is to identify the type of computer to be used in the apparatus. Standard and rugged laptop computers were examined. In the article "A Guide To In-Vehicle Computers," by Joel C. Eberly (2002), the advantages and disadvantages of both standard and rugged laptop computers were discussed. Other advantages and disadvantages are also brought out in the article "Data To Go" (Gary, 2002). In an personal communication with District Chief Michael Hernandez of the Corpus Christi Fire Department in Texas stated "We found the Dell laptops to be adequate, however, we have moved to rugged laptops. Panasonic currently makes an outstanding unit. They are very durable, and take the abuse of day to day operations in the field as well" (M. Hernandez, personal communication, March 2, 2004).

Panasonic, Dell, Gateway, and Motorola all make standard laptops with common specifications. These include a standard Pentium processor, 256 or 512 Megs of RAM, 14" or 15" screen, standard keyboard, integrated 10/100 Ethernet LAN Card, magnesium alloy case, lithium ion battery, and preloaded Windows 2000 or XP Pro software. These are standard specifications and are available to the general public and are warranted for one year.

Panasonic and Motorola were the only two manufactures examined that produce a rugged laptop. "Toughbook 29 features a full magnesium case, moisture and dust resistance design, wireless ready design, and a 1.2 GHz Intel Pentium processor" (Panasonic, [Brochure] 2003, p.1). Other features of the Toughbook 29 include sealed port and connectors covers, 512 Megs of RAM expandable to 1GB, 13.3" with or without touch-screen technology, Lithium ion battery pack, Microsoft Windows XP Professional software, limited 3-year warranty, sealed rubber LED backlit keyboard, and an integrated Global Positioning System (Panasonic, [Brochure] 2003,

p.1).

"Motorola ML 900 features magnesium alloy housing that is fully sealed and meets military specifications for heat and water resistance, fingerprint image reader for added security and can withstand a three foot drop" (Motorola, [Brochure] 2003, p.1). This unit also features an Intel Pentium 4 1.7 GHz processor, 256 Megs of RAM expandable to 1GB, 64 MB Video RAM, 12.1" or 13.3" screen with a touchscreen optional, integrated CD-ROM, fully sealed keyboard with backlit optional, Lithium ion battery and integrated wireless communication options. The ML 900 has a three-year full coverage warranty (Motorola, [Brochure] 2003, p.1).

Connectivity for accessing the E-Plan system is crucial if emergency responders are to acquire critical information on hazardous materials. Since E-Plan is a web-based system a connection must be made via the Internet. Using mobile laptop computers requires a means of connecting to the Internet through wireless technology. In using wireless technology, a connection card is purchased per unit and a charge is incurred per month according to usage or a preset amount of minutes purchased each month per unit. In examining connectivity, four options are available to the HFD.

"The Sprint PCS Connection Card offers secure transmissions, a simple installation process, a monthly fee for unlimited use, and data speeds averaging 50-70 Kbps" (Sprint, 2004 p.1). The service availability area encompasses the HFD corporate limits as well as those areas within Catawba County. "SunCom Wireless offers a mobile network access service in which a data card is inserted into the laptop and serves as a modem" (SunCom, 2004 p.1). There is also a monthly fee associated with this service. Data speed information with this service was unavailable. The service availability area for SunCom covers most of the HFD response area. There are however, some areas of coverage that are unclear. Alltel is another local provider that

provides an access card service. With Alltel, there are basically two plans for the HFD to consider when accessing the Internet and the E-Plan system. "The unlimited data plan allows the user to access the Internet from their mobile computer at anytime without a time constraint on usage" (Alltel, 2004 p.1). Alltel requires a data connectivity kit or a network card be installed for each unit. The other plan limits the time for usage each month and restricts the use of specific sites. Data speeds with this service were also unavailable. Alltel's service availability area encompasses the HFD response area as well as other areas surrounding the City of Hickory.

Verizon Wireless offers a broadband access card that boasts "one of the fastest, fully mobile wireless Internet data solutions available. Quickly download complex files and access your mission-critical data at typical speeds of 300-500 kbps, capable of reaching speeds up to 2Mbps" (Verizon Wireless, 2004 p.1). The service availability area for Verizon Wireless encompasses the HFD response area as well as surrounding counties.

In using the E-Plan system for handling hazardous material incidents, it is imperative that emergency responders not only have an efficient computer they must also have an adequate and reliable connection that is maintained during the incident. This assures quick access to critical information stored in the E-Plan system about the hazardous materials within the facility or a transportation incident involving hazardous materials.

The federal government as a result of catastrophes and environmental interests displayed by the public involving hazardous materials has passed numerous laws. These have included the Comprehensive Environmental Response Compensation and Liability Act (CERCLA), the Resource Conservation and Recovery Act (RCRA), the Clean Air Act (CAA), and Title III, Superfund Amendments and Reauthorization Act of 1986 (SARA). Of these federal laws, SARA has had the most impact on the fire service (Barr & Eversole, 2003).

In 1986, President Reagan signed SARA into law. SARA amended CERCLA and also included a law named the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA), commonly referred to as SARA Title III. The intent of EPCRA is to require information about hazardous materials to be shared with the government and the local community (Kompanik, 2001). EPCRA requires a facility to document, notify, and report certain information to various government agencies as well as the local fire department (Bachman, 1998).

On July 17, 1985, the North Carolina General Assembly passed the Hazardous Chemicals Right-to-Know Act commonly referred to as the North Carolina Right-to-Know Act (NC RTK Act). North Carolina includes requirements for the owner or operator of a facility to report information about hazardous materials to the fire department when certain quantities have been reached (North Carolina Department of Labor, 1999).

While the NC RTK Act and EPCRA require owners and operators to provide information to fire departments about the hazardous materials used or stored at their facility, the method used by fire departments to store and retrieve this information varies. HFD currently receives and stores this information in the form of hard copy. If information is needed at an incident, time becomes a factor in retrieving critical information. Fire departments are realizing the impact that mobile computers can have in terms of data information storage and retrieval at a hazardous materials incident. In his article, "HTML-Based Preplans," Scott Cook (2001) explains that computers are rapidly replacing paper storage systems. In the article, "Top gear: Strathclyde's New Vehicle Mounted Data Management Systems," Jeff Ord (2001) discusses risk information problems during emergency operations. Furthermore, Ord (2001) goes on to explain that in order to deliver the amount of information needed in an emergency situation, and to be able to access the

information in a limited time frame, a computerized system would be necessary.

E-Plan is a web-based integrated contingency handling and planning system. With the E-Plan system, the intent is to simplify filing procedures for regulated required documents by facilities storing and utilizing hazardous materials. Furthermore, it is to provide rapid access to facility information to emergency responders in the event of an emergency (E-Plan Newsletter, 2004).

In order for emergency responders to retrieve critical information on hazardous materials, the information must first be entered. "All of your Tier II data must be in electronic format before you can access it through E-Plan" (Nick Macchiarolo, personal communication, March 2, 2004). Once Tier II forms have been electronically formatted then they can be sent to the University of Texas at Dallas for inserting into the E-Plan system. Once inserted, these forms of information automatically become available to the user once they have signed onto the system via Internet. The Tier II data form contains a wealth of information for the emergency responder. In his article, Bachman (1998) states, "Besides the chemical name and quantity, other site and chemical-specific information must be given on the form, including the physical state, physical and health hazards, and storage conditions" (Bachman, 1998, p.184).

Based on a review of other departments who currently use the E-Plan system, the Internet was the method used for access. The type of connectivity used to gain access to the Internet was a wireless connection that can be acquired through a local wireless provider. Utilizing a connection card that is installed in the laptop computer, the user has the capability of accessing the Internet.

The survey also revealed that of the departments using the E-Plan system, clerical personnel generally transferred Tier II forms into E-Plan manually, and the overall responsibility for maintaining the E-Plan system within their departments was that of a hazardous materials officer.

Departments who were surveyed retrieve information from the E-Plan system through the use of either a search engine or scroll list box for the chemical or facility name. Departments surveyed utilized rugged laptop computers in their apparatus or personal handheld PDA's to facilitate the use of the E-Plan system due to the expected use and wear they would be subject to during operations.

None of the departments surveyed provided any information on the methods or criteria used to select computers for the process, however, "we found the Dell laptops to be adequate, but we have moved to more rugged laptops. Panasonic currently makes an outstanding unit. They are very durable, and take the abuse of day-to-day operations in the field" (Michael Hernandez, personal communication, March 02, 2004).

In summary, governmental requirements are in place requiring the owner or operator of a facility who uses or stores hazardous materials to furnish this information to fire departments. These requirements have been enacted under the EPCRA law and the NC RTK Act. It is the responsibility of the fire department to be able to manage and provide access to these types of critical information during an emergency. While the methods of storing and accessing this information will vary among departments, it is imperative that emergency responders have access to this information in order to make critical decisions during incidents. Quick access must be provided in a user-friendly format.

<div align="center">Procedures</div>

Descriptive research methodology was utilized to develop answers to questions regarding the type of mobile data computers, component specifications, connectivity, entry and retrieval of information surrounding the use of the E-Plan system as well as other fire departments who were using E-Plan. If departments were using E-Plan, then how was access gained and how was

information entered and retrieved as well as the method and criteria used for mobile data computers in this application.

The first research question pertained to what type of mobile data computer and components specifications were needed to access and facilitate the use of the E-Plan system. This question was examined by first identifying the performance requirements needed in a mobile computer to connect to the Internet and provide quick access and maneuverability within the E-Plan system. An examination of several different laptop computer manufacturers was also conducted through the use of the Internet, brochures, and personal communications to determine unit specifications, ruggedness, and applicability. While Panasonic, Dell, Gateway, and Motorola make standard laptop computers with common specifications, Panasonic and Motorola were the only two found to be of rugged design built specifically for emergency service applications. While there were other mobile data computers available on the market, the author found these to be outside the scope of needs for this project, most of which were integrated built-in radio and dispatch components.

The second research question addressed the connectivity options available for accessing E-Plan through the Internet. Four local providers were examined through the use of the Internet, local provider brochures, and personal communications to determine costs associated with airtime minutes, data speeds for sending and receiving information, and service availability area for acquiring and maintaining a connection signal during operations. The author did examine other providers that were available, however, they were not local and instituted long distance charges with a less desirable service area of coverage. A criterion placed on connectivity was it had to at least provide good signal coverage within the HFD response area, preferably countywide.

The third research question focused on how data would be entered and retrieved in the E-Plan system, and who would oversee this. A review of the E-Plan system was conducted as well as a feedback survey from other fire departments, and personal communications. Keeping in mind this is a relatively new program available to emergency responders, the author found only a limited amount of sources available to answer this question.

The final research question focused on how other fire departments access the E-Plan system, enter and retrieve data, and what method or criteria was used to select mobile computers within their department for this application. A feedback summary was developed to provide answers to these questions. The feedback form included questions about use of E-Plan, access, connectivity, personnel access, transferring and retrieval of data, and what other information can be integrated with E-Plan. Other questions of interest included who was responsible for entering and maintaining hazardous material information and if those departments use mobile computers in apparatus to facilitate the use of E-Plan as well as what method and criteria were used to select mobile computers. There was also an additional comments section provided at the end of the feedback survey for additional responses.

Thirty-eight copies of the feedback form were distributed to various fire departments and 16 were returned. There was no particular selection criterion except the fire department maintained a Web site on the Internet. See Appendixes A, B, and C for the relevant cover letters, the feedback form, and a list of participating fire departments. The information obtained from the feedback forms were reported as raw numbers and percentages.

It was assumed that respondents had a basic understanding of Tier II reports. It was further assumed that respondents were familiar with the E-Plan system and electronic data systems. The final assumption was the HFD had already researched other hazardous materials data

management systems and identified E-Plan as the program of choice for departmental needs when writing the FEMA grant. There were several limiting factors that the author accepted. The limiting factors included the amount of published material on the topic of electronic Tier II reporting, the amount of published material on the topic of mobile computers for emergency service use, and the amount of published material on the topic of connectivity. Consequently, a limited catalog of references was available for this project.

Another limitation was the fact the University of Texas at Dallas manages the E-Plan system and requirements are already in place for entry of Tier II forms that limited the author's ability to provide numerous references on data entry and retrieval.

An additional limiting factor was the author's ability to design survey questions, consequently, limited information was provided by respondents. Furthermore, since E-Plan was developed and maintained in the EPA's region six which encompasses the States of New Mexico, Oklahoma, Arkansas, Louisiana, and Texas this limited the number of respondents who could provide beneficial feedback for this project.

Finally, limited information on the feedback survey provided to the author indicated only a few fire departments were using or were even aware of E-Plan, and of those using E-Plan none indicated a method or criteria for the selection of mobile computers for the E-Plan application. Two respondents were in the process of conducting the same research on E-Plan as this author and one was in the process of trying to convert Tier II information into some type of usable format.

<div align="center">Definitions</div>

Hazardous materials- Any substance or material that upon release poses an unreasonable risk to safety, health, or the environment.

Byte- The equivalent of a single character such as a letter, number, or punctuation mark.

Kbps- Kilo bytes per second or one thousand bytes of information transmitted per second.

GHz- Gigahertz or one billion

RAM- Random access memory or a temporary holds data before permanently stored.

MB- Megabyte or one million single characters.

Mbps- Mega bytes per second or one million bytes of information transmitted per second.

PDA- Personal digital assistant otherwise or an electronic handheld information device.

Results

E-Plan was found to be a secured Web-based system that was developed in conjunction with the EPA and the university of Texas at Dallas. E-Plan was developed using common available Internet tools and protocols. One key operational component of E-Plan was the use of LDAP. LDAP is an open-standard protocol for accessing information service and allows information to be distributed among many systems (E-Plan, 2004). The advantages of using E-Plan to manage chemical data from Tier II forms provides emergency responders with quick access to critical information in an emergency situation.

Some unexpected findings in the research were the number of fire departments who were neither using E-Plan nor had heard of this federally funded system. Training to implement and use E-Plan was found to be zero in costs and while Tier information must be in electronic format, users of the system also have access to information on over 22,000 chemicals already in the system. The E-Plan system was also found to have a multitude of valuable links from the cite to the EPA, current weather information for the user's respective community, and an electronically formatted North American Department of Transportation's Emergency Response Guidebook that automatically selects the guide for the chemical on screen and displays it to emergency

responders (E-Plan, 2004).

While the E-Plan system has proven to be as easy as obtaining Internet service and going to the website, other considerations must be examined to determine operational efficiency within each jurisdiction.

1. What type of mobile data computer and component specifications would provide the performance requirements needed to access and facilitate the use of the E-Plan system?

The research clearly demonstrated the need to consider both the advantages and disadvantages of standard and rugged laptop computers (Everly, 2002). However, durability in day-to day field operations was a main consideration for moving away from standard laptops to more rugged laptop computers for the Corpus Christi Fire Department (M. Hernandez, personal communication, March 2, 2004).

Panasonic, Dell, Gateway, and Motorola were all considered but made standard laptop computers that reflected common component specifications. These included a standard Pentium processor, 256 or 512 Megs of RAM, 14" or 15" screen, standard keyboard, integrated 10/100 Ethernet LAN card, magnesium alloy case, lithium ion battery, and preloaded Windows 2000 or XP Pro software. These were standard specifications that were available to the general public and came with a standard one-year warranty for parts and service.

Panasonic and Motorola were the only two manufacturers of rugged laptop computers. While both the Panasonic Toughbook 29 and Motorola ML 900 featured magnesium cases, Motorola's housing was fully sealed and met military specifications for heat and water resistance (Motorola, [Brochure] 2003). Both used a Pentium processor, however, Motorola's ML 900 provided a larger processor compared to Panasonic. Both Panasonic and Motorola units provided expandable Megs of RAM to 1 GB, however, Panasonic's unit came standard with 512 Megs of

RAM as compared to Motorola's 256 Megs of RAM (Panasonic, [Brochure] 2003). Both

models came standard with a 13.3 screen with a touch screen option, and lithium ion battery,

however, Motorola came with a three-year full coverage warranty compared to Panasonic's

three-year limited warranty. Other features Motorola exhibited over Panasonic included a

fingerprint image reader for added security, ability to withstand a three-foot drop, and integrated

CD-ROM. Other options for the Motorola ML 900 included a backlit keyboard for night

viewing and integrated wireless options. Panasonic's Toughbook 29, came standard with a

backlit keyboard and an integrated GPS that was also an advantage brought out in the article

"Data To Go" (Gary, 2002). Panasonic did not meet the extensive rugged specifications as

Motorola.

2. What options are available to provide the connectivity needed to access and facilitate the
   use of the E-Plan system?

Since E-Plan was found to be a Web-based system, a connection must be made to access the

Internet and E-Plan. Using laptop computers requires a means of wireless technology. A local

provider must install a wireless connection card and configure each laptop computer for

accessing the Internet. While the options available are vast, only four were considered because

others were long distance type service cards and costs would have prohibited usage.

Sprint PCS, SunCom, Alltel, and Verizon Wireless were all considered for wireless

connectivity, however, data speeds for SunCom and Alltel were unavailable. Sprint PCS was

found to average 50-70 Kbps in data speeds (Sprint, 2004). A major unexpected finding was that

Verizon Wireless provided 300-500 Kbps data speeds, capable of reaching speeds up to 2 Mbps

(Verizon Wireless, 2004 p.1). This was found to provide quick downloads of complex files and

quick maneuverability in the E-Plan system. This type of connectivity would enhance Hickory

Fire Department's ability to facilitate the use of E-Plan at optimum levels of performance.

Another unexpected finding surrounded the service areas of these wireless providers. While all four service providers were able to provide coverage in most of HFD's response district, SunCom's coverage area was unclear, however, Verizon Wireless' coverage area included the surrounding counties as well as all of HFD's response district. Verizon Wireless provided the fastest data speed and largest coverage area while maintaining a sustained clear signal than Alltel, SunCom or Sprint PCS. With mutual aid agreements throughout the county, this type of service would enhance Hickory Fire Department's ability to provide other agencies with critical information from the E-Plan system should a hazardous materials incident occur.

3. How would data be entered and retrieved and who would oversee this process?

The intent of EPCRA was to require the sharing of hazardous material information with both the government and local communities (Kompanik, 2001). To facilitate this process, EPCRA requires a facility to document, notify, and report certain information to various federal agencies as well as the local fire department (Bachman, 1998). The NC RTK Act also requires an owner or operator of a facility to report hazardous materials to the fire department when certain quantities have been reached (North Carolina Department of Labor, 1999).

In order to extract this critical information from the E-Plan system in a quick timeframe, a computerized system is needed as (Ord 2001) indicated as well as aiding in a reduction of risk information problems encountered by emergency responders during emergency operations. Fire departments are realizing the impact that mobile computers are having in terms of data information storage and retrieval at hazardous materials incidents. In doing so, computers are rapidly replacing paper storage systems (Cook, 2001).

Before Tier II information can be entered into the E-Plan system, it first must be transferred

into electronic format and then sent to the University of Texas at Dallas for insertion. (N. Macchiarolo, personal communication, March 2, 2004). Once inserted into the E-Plan system, this information becomes available to the user once they have logged onto the system via Internet. Some types of critical information on chemicals obtained through Tier II reporting that can be transferred into E-Plan include chemical name and quantity, physical state, physical and health hazards, and storage conditions (Bachman, 1998, p.184).

Information is generally transferred into the E-Plan system manually. Editing information is also manually performed. Retrieval of information is obtained through the E-Plan website by logging on, providing a password, then the user types in a parcel or full chemical name or a facility name to gain access to that information. Once the chemical is found, the user has other critical links on the E-Plan site to navigate that will provide more extensive information either about the chemical or on the facility.

4. How have other fire departments facilitated E-Plan system access, entry and retrieval of data, and what method was used to select mobile data computers for this application?

A total of 38 survey instruments were mailed out to other fire departments across the United States. A total of 16, or (42%) were returned with some interesting results. Only 3, or (8%) of fire departments were using E-Plan, 1, or (2.6%) department was in the process of implementing E-Plan, 2, or (5%) were in the process of researching E-Plan for their departments to utilize, 7 (19%) did not use E-Plan and 3 (8%) had never heard of E-Plan. The three (8 %) departments who were currently using, implementing, or researching E-Plan provided the following responses to survey questions:

1. Does your department use the E-Plan system as a tool for managing hazardous materials?

   3 – Yes   0- No

2. How does your department access the E-Plan system?

    3- Internet

3. If access is gained through the Internet, how is connectivity provided?

    2- Wireless connection   1- T-1 cable line

4. When accessing E-Plan is there a required user identification and password?

    3- Yes

5. If so, do all personnel have access with a common user identification and password, or

    must each user obtain their own identification and password?

    2- Individual user ID and password   1- Common Password and ID

6. Does your department use the E-Plan system to enter hazardous material data?

    2- Yes   1- No

7. If so, how is this accomplished?

    2- Tier II forms are transferred manually into E-Plan   1- Sent to University of Texas

8. In your experience, what other types of information can be integrated with E-Plan?

    3- Building plans and Geographic Information

9. List any other types of information that can integrated?

    Emergency Operations Plans, hydrant locations, contact information, and storage

    quantities

10. Who has the overall responsibility for maintaining the E-Plan system?

    2- Hazmat officer   1- Chief Officer

11. Who is responsible for entering and maintaining up-to-date hazardous materials

    information in E-Plan?

    3- Assigned clerical personnel

12. How is information retrieved from the E-Plan system once it has been entered?

    3- search engine or scroll list

13. Does your department use mobile data computers to facilitate the use of E-Plan in

    apparatus?

    2-No   1- Use PDAs

14. If so, what method and criteria were used to select mobile data computers within your

    department?

    3- No answer was given on survey instrument

Discussion

Hazardous materials impact our way of life everyday and are essential to our standards of

living. Under certain conditions, however, they can become a nightmare for emergency

responders infecting harm to the citizens we serve and causing damage to property and the

environment. The City of Hickory's core obligations are health and safety, public welfare and

security, emergency response, and safeguarding public assets (Young, 2000). The HFD is

attuned to the dangers posed by hazardous materials when combined with potentially natural or

man-made disasters and is working to become even more prepared for these type risks (NRT,

2001). The City of Hickory's multi-disaster plan assigns the HFD the responsibility of

identifying and documenting the types and amounts of hazardous materials located in the

facilities within the city's jurisdiction.

The possibility of encountering hazardous materials at a given incident within the City of

Hickory is more prevalent today than in past years. The U.S. Department of Labor estimates that

there are over 650,000 existing hazardous chemicals with hundreds of new ones being produced

annually (U.S. Department of Labor: Occupational Safety & Health Administration [OSHA],

July 5, 2003, p.1). While most major disasters are extremely rare in the City of Hickory,

reported incidents involving spills, leaks, and releases are becoming more common (NRT, 2001).

It is important that the HFD take advantage of both federal and state laws that require

facilities to report this information and coordinate with industry to create user-friendly electronic

formats so Tier II information can be transferred into the E-Plan system for HFD access.

To respond and handle incidents involving hazardous materials, a different mindset must be

learned and applied. Potential risks associated with these type incidents are not only dangerous

but also disastrous (Peterson, 2004). The type of material involved, quantity, location, and

weather conditions are just some types of information emergency responders need early in the

incident to start making decisions that will reduce the risk to themselves, the community, and the

environment.

Currently, hazardous materials information obtained from facilities in the City of Hickory is

maintained by paper copy. In the event of an emergency time is crucial and paper documents

require time to gather and retrieve. This is valuable time that could be spent mitigating the

incident at hand.

E-Plan was developed through a coordinated effort between the University of Texas at Dallas

and the EPA. E-Plan is a federally sponsored, highly secure system designed to make hazardous

material information immediately available online (E-Plan, 2004). E-Plan incorporates

electronically formatted Tier II information with a host of informational links that provide the

emergency responder with quick accessible information they need to understand the hazards they

may be facing.

This research demonstrated that considerable amounts of information are generated as a result

of both federal and state legislation requiring hazardous chemical users to file reports with local

emergency responders. Furthermore, this research signified the value that a tool such as E-Plan

could provide the Hickory Fire Department with respect to hazardous material data management

and emergency response.

Operational components to facilitate the use of E-Plan in the HFD included an examination of

mobile computers for apparatus. It is important that the HFD select a laptop computer that is

durable and will take the abuse of day-to-day operations in the field (M. Hernandez, personal

communication, March 2, 2004). In doing so, the HFD must consider both the advantages and

disadvantages of standard verses rugged laptop computers (Eberly, 2002). Due to the emergency

service design, the author was limited to the examination of Motorola and Panasonic. As a result

of E-Plan being relatively new to fire service, the author was limited, in that, no fire department

surveyed provided any information for the method or criteria used to select computers.

Motorola ML 900 provided both standard and optional features that would be practical to the

needs of the HFD for facilitating the use of the E-Plan system (Motorola, [Brochure] 2003). The

specifications of this unit would also allow for future expansion of programs and would further

promote the value of laptop computers within the HFD.

Connectivity for accessing the E-Plan system is crucial, since it is a web-based system. In

order to accomplish access through the use of laptop computers a connection card that maintains

a reliable connection must be used. This research project included four providers. While all four

could provide a basic connection, Verizon Wireless exhibited the most reliable and sustained

connection for Hickory Fire Department's use (Verizon Wireless, 2004 p.1). Verizon Wireless

was the fastest among the four in download capabilities as well as its operational speeds. The

Hickory Fire Department is subject to responding outside of its own service area to assist other

departments in surrounding counties and Verizon Wireless would provide an extended coverage

area of sustained connection service for the use of E-Plan through mobile computers in apparatus.

In the emergency service arena information has become one of the most critical components for accessing emergency responder's safety and for making critical decisions that could impact the outcome of an emergency incident. Furthermore, time becomes a factor in retrieving this information, however, fire departments are becoming more attuned to the capabilities of mobile computers and how they can enhance the management of hazardous materials data and replace paper storage systems (Cook, 2001). In turn, E-Plan can enhance the HFD's information capabilities before and during hazardous materials incidents, thereby reducing risk information problems within a limited time frame (Ord, 2001).

The research identified the benefits to be gained by the HFD in using the E-Plan system. While Tier II reports must be electronically formatted as stated by (Nick Macchiarolo, personal communication, March 2, 2004), they provide a wealth of information to emergency responders that include the physical state of the chemical being stored, physical and health hazards, and storage conditions (Bachman, 1998 p.184).

It is imperative that the HFD take advantage of the hazardous materials information available through federal and state legislation. Both EPCRA and the NC RTK Act provide avenues for the HFD to pursue in terms of both compliance and obtaining critical data to be used during emergency incidents.

While E-Plan may not be the only hazardous materials system available, the research indicated that the HFD would benefit greatly from this federally funded, secure web-based system that was designed with the focus on accessing information about hazardous materials in a limited time frame to a specific location (E-Plan, 2004 p.1).

The organizational implications of the research indicate that the HFD must move forward with employing E-Plan as a hazardous materials data management system. HFD must also provide laptop computers that are durable for day-to-day field operations in their apparatus with secure and reliable wireless connections to the Internet, allowing responding units access to the E-Plan system.

Recommendations

The purpose of this research was to identify the operational components that would complement the grant funding to purchase mobile computers, which would facilitate the use of the E-Plan system. The first recommendation is to move forward with employing the E-Plan system for managing hazardous materials data before and during hazardous materials emergencies. This is a federally funded secure web-based system that is easily accessible through the Internet and provides an extensive information base within a limited time frame to emergency responders. There is no cost to the HFD for accessing and using this system as compared to other commercial software systems that would make this type of tool cost prohibitive to the HFD. The value of the E-Plan system would provide a positive impact on safety of emergency responders and the community, as well as property, and the environment.

The second recommendation is that the HFD move forward with selecting a mobile computer and connection provider that provide a reliable and sustained connection to the Internet for facilitating the use of the E-Plan system. A committee comprised of firefighters that would be using the product, along with the involvement of a representative of the City's Information Technology Department, should be selected to make the final recommendations. Out of all the computer units and connectivity providers researched, only the following should be considered: Motorola ML 900, Panasonic Toughbook 29, and the Verizon Wireless

connection card.

The fourth recommendation is to start gathering information about the cost of the computers and connectivity as well as the cost of installing them in the apparatus. The dollar amount will need to be included in the grant process. This is another area where the support and expertise of the Information Technology Department is invaluable.

The fifth recommendation is to involve the Fire Prevention Bureau and the Fire Education Specialist to help design and implement an educational program for business owners who store and use reportable quantities of hazardous materials. This educational component would be designed to educate owners about E-Plan's capabilities, security, and how costs could be reduced through electronic reporting of Tier II reports into the E-Plan system. The Fire Prevention Bureau currently manages Tier II reports received by the department and would be best qualified to manage and oversee the data entry process. This is an area were the E-Plan manager at the University of Texas could probably provide some valuable support.

The sixth recommendation is to involve both the Training Division along with the E-Plan system manager at the University of Texas for recommendations and guidance in scheduling training for HFD personnel on the use of the E-Plan system. Individuals that are lacking those skills needed to operate mobile computers should be encouraged and provided with assistance that will enhance their capabilities to access and maneuver through electronic information.

The seventh recommendation is that standard operating procedures will need to be developed to incorporate the use of E-Plan and mobile computers in apparatus. Currently, the HFD has no standard operating procedures for computers in apparatus, however, the Hickory Police Department and the Catawba County Sheriff's Office both utilize mobile computers within their vehicles and could provide support in this area.

The final recommendation is for the Fire Chief to appoint someone to oversee this process. This person will need to develop goals and objectives with timelines. This person would also act as the liaison between the HFD and the E-Plan manager. This person should be familiar with Tier II reporting requirements and have a thorough understanding of the E-Plan system.

In conclusion, based on the findings of this research project, the HFD should take the necessary steps for incorporating E-Plan as a hazardous materials data management tool facilitated with the use of mobile computers in apparatus based on the grant funding provided by FEMA.

Future researchers may be inclined to explore other software systems that are employed using mobile computers in apparatus such as computer-aided dispatch.

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Appendix A

Hickory Fire Department

City of Hickory
19 Second Street Drive NE
Hickory, NC 28601
Phone (828) 323-7420
Fax (828) 323-7566

DATE: September 7, 2004

Greetings:

I would like to take this opportunity to introduce myself. My name is Rick Davis and I am a Battalion Chief at the Hickory Fire Department located in North Carolina. I am currently enrolled in the National Fire Academy's Executive Fire Officer Program. As a participant in this program, I am required to complete an applied research project.

The purpose of my research is to identify the operational components that will complement grant funding received by the Hickory Fire Department to facilitate the use of a secure web-based hazardous materials information system called E-Plan. I have enclosed a survey that is needed to complete the research portion of the project. I would appreciate your assistance in having the appropriate member of your department complete the survey and return it within the next 10 business days. I have enclosed a self-addressed stamped envelope that can be used to return the survey.

If you would like to review the results of the survey or have any questions, please do not hesitate to contact me. Thank you for your cooperation.

Sincerely,

Rick Davis
Battalion Chief

Enclosures: Operational Components Feedback Form
             Self-addressed stamped envelope

Appendix B

E-Plan Operational Components Feedback Form

The following questions are related to the accessibility, connectivity, data entry and retrieval, and mobile data computer selection for using the E-Plan system. Please answer the questions to the best of your ability. A comment selection has been provided at the end of the form for any additional information or explanation of the information you have provided.

PLEASE PRINT

Name:_____ Title:_____

Fire Department:_____ Telephone: (_____)_____

14. Does your department use the E-Plan system as a tool for managing hazardous materials data?

Yes_____   No_____

14. How does your department access the E-Plan system?

Internet_____   Software Application_____

14. If access is gained through the Internet, how is connectivity provided?

Wireless connection _____ Other_____

14. When accessing E-Plan is there a required user identification and password?

Yes_____   No_____

14. If so, do all personnel have access with a common user identification and password, or must each user obtain their own user identification and password?

Common user ID and Password_____   Individual user ID and Password_____

14. Does your department use the E-Plan system to enter hazardous material data?

Yes_____   No_____

14. If so, how is this accomplished?

Tier II forms are transferred manually into E-Plan_____

Information is scanned into Eplan_____

Other method_____   Explain_____

14. In your experience, what other types of information can be integrated with E-Plan?

Building Plans_____   Geographic Information_____

14. List any other types of information that can be integrated?

_____

_____

14. Who has the overall responsibility for maintaining the E-Plan system?

Clerical Personnel_____   Hazmat Officer_____   Chief Officer_____   Other_____

11. Who is responsible for entering and maintaining up-to-date hazardous materials

information in E-Plan?

Hazmat Officer_____   Chief Officer_____   Assigned Clerical Personnel_____

12. How is information retrieved from the E-Plan system once it has been entered?

Search engine_____   Scroll list_____   Select from a list_____   Other_____

If other, please   explain_____

13. Does your department use mobile data computers to facilitate the use of E-Plan in apparatus?

Yes_____   No_____

14. If so, what method and criteria were used to select mobile data computers within

your department? Please Explain

_____

_____

Additional comments_____

Appendix C

Participating Fire Departments Responding

Albany Department of Fire & Emergency Services, Albany, NY

Charlotte Fire Department, Charlotte, NC

City of Memphis Fire Department, Memphis, TN

City of Miami – Department of Fire & Rescue, Miami, FL

City of Raleigh Fire Department, Raleigh, NC

Corpus Christi Fire Department, Corpus Christi, TX

Dallas Fire & Rescue, Dallas, TX

El Paso Fire Department, El Paso, TX

Jonesboro Fire Department, Jonesboro, AR

New Orleans Fire Department, New Orleans, LA

Oklahoma City Fire Department, Oklahoma City, OK

Pittsburgh Bureau of Fire, Pittsburgh, PA

Plano Fire Department, Plano, TX

Portland Fire & Rescue, Portland, OR

Portland Maine Fire Department, Portland, ME

Town of Cary Fire Department, Cary, NC